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A GEOGRAPHICAL QUESTION IN THE LIGHT OF HISTORY

by

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DURING the last few years much attention has been drawn to the serious effect which intensive human activity in the form of excessive exploitation of the soil for crop growing has had upon the physical aspects of large areas of the Middle West of the United States and consequently upon their climatic conditions. Changes of a similar kind due to human causes and the influence exercised by them for centuries are strikingly illustrated by the vicissitudes which the great plain of the Alföld of Hungary, between the Danube and Tisza, together with adjacent tracts, underwent for some 160 years through the Turkish invasion of the sixteenth century and the devastations of the subsequent wars. The physical results produced by these historical events have been graphically described by Professor J. Szekfű, the eminent historian, in a well-documented chapter of his and Professor Hóman's great *History of Hungary*. The facts there recorded supply a special reason for dealing in these pages of *The Hungarian Quarterly* with some closely related aspects of a much discussed geographical question, that of "desiccation." These aspects, perhaps because their examination calls for combined physiographic observation and critical antiquarian research, seem to have received less attention than they deserve on the part of geographers and a wider public. And yet that geographical question has a direct bearing upon the economic conditions of our modern world.

In his analysis of the results of the Turkish invasion after the fateful battle of Mohács, 1526, and of the intermittent warfare which followed it for more than a century and a half, Professor Szekfű points out how the prolonged devastations accompany-

ing them led to a rapid depopulation of the before well cultivated and closely-settled countryside ; how the naturally fertile ground, no longer tilled and also deprived of the protection of its woods, within a couple of generations assumed the character of a bare arid steppe lacking adequate humidity and hence liable both to denudation and the invasion of drift sand. Without a population concerned with the control of seasonal floods, the recurring inundations from the great rivers, spreading unchecked over the level flat of the plain, produced wide belts of marsh land. On drying up they left behind saline deposits such as have ever since made that land hard to reclaim for profitable cultivation. The stagnating waters bred malaria, and this together with other diseases, endemic on wasted ground lacking suitable foodstuffs and frequently even drinkable water, in time caused these once flourishing tracts to be dreaded by contending armies and for a long time also by returning settlers. Professor Szekfű's careful description shows the extent to which these results of destructive human activity have helped here to produce or to intensify such physical drawbacks as climatic extremes and protracted seasons of aridity. These have retarded resettlement long after those adverse human factors have ceased to have free play, and still make themselves adversely felt.

Now if we were to observe the conditions here sketched in the barest outlines without any historical knowledge of the human causes which brought them about, we should easily be led to compare them with those prevailing in great arid wastes of Asia and Africa and to ascribe their creation to a purely physical process to which the term of "desiccation" is conveniently applied. When modern geographical research first turned its attention to the deserts of North Africa, Arabia, Central Asia, etc., it was naturally influenced by the apparent analogy of those vast but slow geological changes which have transformed the surface of our globe in the course of millions of years. It was hence prepared to seek the explanation of the process which has produced those deserts in a gradual change of climate tending towards aridity and asserting itself all over the globe, *i. e.*, in "progressive desiccation." Owing perhaps to the fact that compared with the great length of geological periods the span of time known to us from properly recorded

history may appear like a mere yesterday, this theory of "progressive desiccation" did not concern itself closely with a critical examination of such historical facts as were assumed to support it, or with the possibility of some of these facts having been due to factors distinct from climatic change. Still less did this theory claim to offer definitive explanations for important developments of human history as we know them from written records or remains of antiquity.

It was different when another "working theory," that of "pulsatory climatic change" producing desiccation over limited areas and periods, was first set forth by Professor Elsworth Huntington in his *Pulsation of Asia*. In this brilliantly written book the distinguished American geographer described observations made by him mainly in 1905/06 on a journey through the great arid basin of Chinese Turkistan. In the course of his journey he had visited a number of ancient sites which had been abandoned to the moving sands of the Taklamakan desert between the third and eighth centuries A. D. and which I had been able to explore on my first Central-Asian expedition of 1900/01.

Professor Huntington accepted the dates which written documents, brought to light by systematic excavation at sand-buried ruins, had enabled me to determine for the abandonment to the desert of these ancient settlements. He then proceeded to deduce from them certain cycles during which secular alternations of climatic conditions were assumed to have produced a serious reduction in the annual rainfall. This he believed to have rendered cultivation, here dependent wholly on irrigation, no longer possible, and thus caused those settlements to be deserted by their inhabitants. These assumed periods of increased aridity he believed to have affected also the great grazing areas to the east and north of the Tarim basin, and thus to have given rise to the well-known westward migrations of nomadic nations like the Huns and others from Central Asia. Thus Professor Huntington was led to ascribe to such intermittent "desiccation" events profoundly affecting the history of Europe, such as the downfall of the Roman Empire and the great Mongol invasions devastating Eastern Europe. He subsequently attempted on similar lines to find support for this theory by seeking for indications of corresponding cycles of climatic change in the Mediterranean region and elsewhere in the West.

A region like that innermost portion of Asia, the Tarim basin, would obviously offer itself as ground particularly suitable for observing evidence of climatic change if any; peculiar physical features, such as its position far away from all moisture-producing seas and the barriers raised by the high mountain ranges enclosing it, are bound to render it exceptionally arid at all times. For where settled life is possible only in oases dependent on irrigation from canals, any diminution in the available volume of water would necessarily affect the cultivable area and hence also human occupation. But at the same time it is easy to realise how much such occupation under quasi-artificial conditions is likely to be affected by the manifold and often very complex factors governing human activity.

These twofold considerations induced me to pay special attention to that theory of "climatic pulsation" in the course of my subsequent long Central-Asian expeditions which in 1906—08 and 1913—15 carried me back to the deserts of Chinese Turkistan and to the oases, existing or dead, to be found along them. There was a special inducement for this also in the fact that here, as so often in the case of questions appealing to general interest, an assumption put forward as a "working theory" has gradually come to be treated as an established fact in publications for a wider public and to be used as evidence in dealing with other problems.

In the course of these investigations, extended subsequently from the extreme north-west of China proper right through Central Asia down to the arid coast of the Arabian Sea and the Persian Gulf, I have had ample opportunities to convince myself how difficult it is, even where the change in conditions is most patent, to distinguish in the absence of definite record, and after the lapse of centuries, between what is the result of purely physical causes and the cause which originally started the change. Brief reference to what is probably the most interesting of the ancient sites explored by me in the sands of the Taklamakan desert will help to illustrate this observation.

Some 80 miles to the north of the present small oasis of Niya, situated to the east of Khotan, and fully 30 miles beyond the point where the river feeding its canals finally dies away amidst the drift sand of the desert, there stretch the remains of an ancient settlement known from the Chinese Annals by the

name of *Ching-chüeh* and from the early documents, written in Indian language on wood or leather, which I excavated there, by that of *Chadota*. From these documents, brought to light by the hundred, and from the abundant relics of ancient life there recovered, it is certain that this now sand-buried settlement was abandoned to the desert towards the close of the third century A. D. The extreme dryness of the climate — nowhere within the plains of the Tarim basin does the annual amount of precipitation exceed about 2 inches — has allowed all these relics to survive in wonderful preservation, *e. g.*, the trunks of dead trees still rising above the sand in arbours and orchards near the deserted habitations.

It would be very tempting to explain the abandonment of this ancient oasis as a direct result of "desiccation" which caused the river once feeding its canals to dry up, and thus depriving the land of the indispensable irrigation forced the people to move away. Yet there is an obvious archaeological fact which ought to warn us against adopting this explanation *a priori* as conclusive. I mean the fact that if the climate there had not been for generations before as dry as it certainly has remained since the oasis was abandoned, all those letters, records, etc., on wooden tablets or leather, dated in different reigns of the local petty chiefship, together with many other frail objects liable to decay, as found in refuse heaps and so on, could not have remained practically in as fresh a state as they were when thrown away. Equally certain it is that no amount of engineering skill could now make the waters of the Niya river reach the point where near the southern end of the dead settlement a fallen footbridge lying across a dry bed still proves them to have flowed once. There is thus afforded indisputable proof of a great shrinkage in the volume of the river since the third century A. D. But it would be a mistake to construe this *post hoc* into a *propter hoc* accounting for the abandonment of the ancient oasis.

We may well be guarded against such a hasty conclusion by comparison of what is to be observed at another ancient site explored by me in the Taklamakan desert near the terminal course of the Endere river some 70 miles away to the south-east. There the remains of an old settlement, smaller than the one last noted but of similar type, are proved by documents

I excavated to have been abandoned also towards the close of the third century A. D. Hsüan-tsang, the great Buddhist pilgrim, passing there in the first half of the seventh century A. D. saw it in ruins. But significantly enough the river still passes within easy reach of the site, and I found its water still ample enough to irrigate the fairly extensive cultivated area of a modern colony established some six miles further down the river. Both the ancient sites derived their water from rivers fed by the snows and glaciers of the same high K'un-lun range to the south, and yet there is that marked difference in their respective position at present as regards irrigation resources. It is clear that the assumed desiccation could not have affected the two oases uniformly. Hence the question necessarily arises whether the reason for the simultaneous abandonment of both oases ought not to be looked for elsewhere.

Now it is certainly noteworthy that the time of abandonment here and at several other ancient sites of the Tarim coincides with the period when we know from Chinese historical records that the domination of the Han dynasty ceased. This had assured peace and order in this outlying Central-Asian possession of the empire and when ended, gave way for several centuries to internal strife and invasions. History proves that effective Chinese political control over the Tarim basin has always meant a period of security and prosperity for the petty states that share its oases. The collapse of that control, as the experience of the last few years sadly illustrates, has invariably been followed by wars and rapid economic retrogression.

On ground where the conditions of cultivation are wholly dependent on the maintenance of canals, which only a strong local administration can assure, prolonged periods of war or internal disorder are bound to lead very soon to a reduction in the size of oases or even to the complete abandonment of outlying ones. Similar results may be produced by a variety of other causes entirely, or at least partly, of human origin, such as devastating epidemics, diversion of traffic and trade causing labour to recede from certain oases separated from others by wide stretches of desert, and so forth. On ground thus abandoned to the desert, ever close at hand to overrun it with its dunes, and subsequently left unreclaimed, the ancient remains preserved through the constant aridity of the climate may enable us

to fix the time of abandonment. But unless definite evidence in the shape of reliable record or unmistakable archaeological indications is available we must refrain from definitely assigning this abandonment to a particular cause. Such conclusive evidence, unfortunately, has not been found by me at any of the ancient sites explored in this region. Nor would it be safe to make up for its absence by a "working theory," seeing that where matters of the past connected with human activity are concerned it is impossible to apply experimental tests such as a "working theory" needs to be really useful.

Before I proceed by a few examples taken from Asia to illustrate the effect which human activity, whether productive or otherwise, may exercise upon the physical aspects of certain ground, I may briefly refer to a question which may well be raised by the conditions which prevail, as we have seen, at the ancient oasis no longer reached now by the Niya river. Here we have a definite case of the amount of water carried by that river having greatly diminished during the last sixteen centuries. On the other hand the remains preserved at the dead oasis afford clear proof that climatic conditions quite as arid as the present ones prevailed in this part of the Tarim basin before its abandonment.

The apparent contradiction of these two observations is adequately accounted for by an explanation first suggested to me by Sir Sidney Burrard, the late Surveyor General of India and a great authority on Himalayan geography. He thought that the diminished volume of this and other rivers in the Tarim basin was due to the shrinkage of the glaciers on the high ranges which are their main feeders. While the climate in the great trough below has experienced no appreciable change during historical times, the vast reserves of ice left behind in those glaciers by the last glacial period have been undergoing slow but continuous reduction through the milder climatic conditions of the present post-glacial period as known from geological evidence. It is this slowly diminishing store of "fossil ice" from which the rivers of the Tarim basin and the oases within them mainly draw their supply of life-giving water.

The careful topographical surveys carried out on each of my Central Asian expeditions have afforded me ample oppor-

tunity to observe how rapidly on ground where settled occupation is possible only with the help of irrigation the limits between cultivation and absolute desert conform to the uncertain chances of human activity. Again and again while moving along the string of oases by the southern edge of the Taklamakan I observed after intervals of six or seven years separating my successive journeys that their areas of cultivation had advanced considerably towards the sandy wastes of the desert, in some cases by several miles. The record provided by the mapping done on each journey proved that this advance was directly due to the settled peaceful conditions produced by the re-establishment of the Chinese régime in the Tarim basin towards the close of the last century, and the increased pressure of population which followed it. Reliable information showed that during the troubled times of the great Muhammadan rebellion which preceded it, the population of Khotan, the largest of the southern oases, had shrunk to about one half. Unfortunately there is only too much reason to believe that during the recent years of upheaval and disorder which have followed in the Tarim basin after my fourth Central-Asian journey, depopulation and recession of the cultivated areas there and in the neighbouring oases have been steadily proceeding.

On historical grounds there is every reason to assume that an exactly corresponding process followed the breakdown of Chinese political control after the downfall of the Han dynasty in the third century A. D. It was the case again when towards the close of the eighth century internal troubles in China proper under the T'ang caused the Empire to abandon Turkistan for a thousand years to Tibetan and other invasions. It is obvious that if for some historical reason, difficult to trace on account of inadequate record, an outlying area once abandoned were left unoccupied for a series of centuries, its subsequent reclamation may become increasingly difficult or altogether impossible, as in the case of the ancient oasis beyond the terminal course of the Niya river, owing to slow but continuous shrinkage having taken place meanwhile in the volume of water available for irrigation.

The uncertainty which would arise in such a case about the original cause of abandonment and its possible bearing on the

question of "desiccation" may well be illustrated by the following instance, partly observed in the broad daylight of our own time and partly assumed for the sake of hypothesis. Reliable information gathered from a young Hungarian geographer, at the time a prisoner of war in Russian Turkistan, shows that during the years following the Soviet revolution of 1917 some villages situated near the terminal course of the Zarafshan river below Samarkand were abandoned by their inhabitants owing to irrigation of their land having become impossible as the volume of water available in their canals had for several years proved wholly inadequate.

This deficiency of water was not due to any natural cause such as a reduction in the volume of water which the Zarafshan receives mainly from the great glaciers at the head of its valley, or to any local change of climatic conditions, but solely to the fact that owing to the disorganisation of the Russian administration in the province which followed upon the revolution, the villages higher up the river were all helping themselves to a greater amount of water for the service of their canals than previously allotted. This tendency among cultivators towards excessive use of irrigation can easily be observed in India or elsewhere in the East wherever cultivation is exclusively dependent on irrigation. If careful control over the distribution of water among the various canals were to cease for a time, the lands lower down would necessarily become deprived of their needful allotment of water, and abandonment of those lands would inevitably follow.

Now let us assume that those disturbed conditions were to continue a long time and for this reason or owing to the influence of some other purely human factor, such as depopulation, diversion of trade routes, change of administrative policy, the land were permanently to pass out of occupation. In that case it would be still possible for an archaeologist, say after two thousand years, from coins or other datable relics to determine the time when the settlement fell into ruin and the desert, ever close at hand, regained its hold over the ground. If then some geographical student of the future were inclined to look further afield for apparent indications to support a "working theory" assuming a serious change in climatic conditions he might well be induced to stress the fact that

great destructive events were proved by records to have taken place just about the same period in Russia and Western Europe. He might thus be led to conclude that these, too, had resulted from the same serious climatic change affecting agriculture and all economic conditions throughout Asia and Europe which had brought about the abandonment of good land in the terminal portion of the Zarafshan valley. Yet we being so near in time know that in reality the causal nexus between the facts observed lay just in the opposite direction. For it was one of the many far-reaching effects of the Great War which, through the Russian revolution, caused the local administration in that portion of Central Asia to break down for a time and thereby deprived an outlying portion of the once cultivated area of the means for maintaining irrigation.

Let me turn now in conclusion from those arid regions to another part of Asia more favoured by nature with which I have been fortunate enough also to become familiar. There, too, we can find examples showing how important it is to pay due regard to the effects of human activity — or its reverse — when dealing with physical changes observed on the ground. I may take one of these examples from the great valley of Kashmir. Blessed by nature in her kindest mood with a temperate climate and adequate moisture, it has not unjustly been described by François Bernier, that early and most observant visitor to Kashmir in the seventeenth century, as the "Paradise of the Indies." Unlike the rest of India, Kashmir has proper historical records dating back to Hindu times, among them a Sanskrit chronicle, reliable from the seventh century A. D. onwards. The prolonged labours I devoted during my early years in India to the publication and interpretation of this chronicle, the *Rajatarangini*, have made it easy for me to recognize and account for changes in some of the physical aspects of this alpine land.

On the lower slopes of the high Pir Pantsal range which separates and, like a great natural rampart, protects Kashmir from the plains of the Punjab, there stretch at elevations from 6,000 to 8,000 feet rolling uplands abundantly watered by fine mountain streams and well suited for cultivation. References in the *Rajatarangini* show that much of these downs was occupied by villages during the Hindu period down to the twelfth century

A. D. Yet the maps of the first survey made of Kashmir in the 'fifties of the last century mark almost the whole of this ground as covered with dense conifer forests. Much of it has remained so to the present day in spite of the ever increasing amount of grazing, generally destructive to tree growth, and of new settlement brought about by pressure of population under improved administrative and economic conditions.

We might well be induced to ascribe the spread of luxuriant forests during the last seven or eight hundred years to a climatic change more favourable to tree growth, did not history teach us that it was in reality directly due to the conditions of political anarchy and oppression which prevailed in Kashmir during the later Hindu reigns and most of the succeeding Muhammadan period. This produced for centuries a steady decrease of the population and with it a gradual abandonment of all outlying cultivation, less productive than the rice fields in the open valley plain and more difficult to protect from general insecurity and raids. Nature was ready at hand to resume what human occupation had wrested from its free sway. Now the process is being slowly reversed. It must be hoped that proper forest administration will prevent excessive grazing and keep off the danger of denudation from ground which prolonged anarchy had beneficently protected and clothed with an abundance of valuable timber.

I may quote a similar example from Darel and Tangir, two interesting and very little known valleys of the Hindukush which I had the chance of exploring as the first European visitor at the beginning of my third Central Asian expedition. They are situated above the Indus valley where the great river makes its sharp bend after passing through the as yet inaccessible gorges of independent tribal territory of the Indus Kohistan. On moving through Darel and Tangir in 1913 I was greatly struck by the magnificent conifer forests covering the slopes of the high mountain spurs which enclose these valleys, while the slopes in the main Indus valley both above and below those hill tracts are everywhere absolutely bare of tree growth. I may point out here in passing that this difference, I believe, is wholly due to the fact that the moisture-laden current of the south-west monsoon travels unchecked up the gorges of the Indus from south to north to where the river makes its sharp

bend to the south-east below Tangir. Held up by the barrier of the high Hindukush range, the Monsoon clouds pour out their life-giving water to produce fertility such as the mountain tracts near the river's course nowhere else know.

What, however, calls for notice in this place is the fact that again and again amidst the splendid forests clothing the steep slopes in Darel and Tangir I came upon unmistakable old terraces laid out for fields and now overgrown by magnificent firs and pines centuries old. Here, too, a traveller unacquainted with the past of the land might readily be induced to assume a climatic change. In reality a ready explanation is furnished by the barbarism into which these tracts have lapsed for many centuries. When pious Buddhist pilgrims from distant China from the fifth to the seventh century A. D. made their way here down to the Indus and then by the difficult track they knew as the "route of the hanging chains" to the sacred sites of north-western India, they found in Darel flourishing Buddhist communities with a population large enough to need whatever ground on the steep slopes could be secured for cultivation. There is nothing in the shape of written record or even tradition to be found among the independent and turbulent Dard tribes now occupying these valleys. But the conditions of constant feud and rapine prevailing among them furnish an adequate explanation why nature for centuries past was given the chance of recovering most of the ground it had lost through human activity during peaceful Buddhist times.

How easily a mere accident of local history can affect the contest between nature untrammelled and human activity, so often destructive, may be illustrated by a brief reference to the story of Raja Pakhtunwali. This member of the Khushwakt family, long established in neighbouring Hindukush tracts, had as an exile during troubled times sought refuge in Tangir. By skilful intrigue among contending tribal factions and a series of successful murders he had made himself master for a time of Tangir, Darel and Sazin on the Indus. It was his rule which rendered my visit possible. To maintain his hold over the little kingdom he had built up for himself, to pay his mercenaries recruited from outside, and so on, he needed money.

The temporary security assured by his rule over the turbulent tribes made it possible for him to obtain this by selling contracts to enterprising Pathan traders for timber to be floated down the Indus. So on my visit I found tree-cutting operations progressing on a large scale with hundreds of hillmen brought in from Upper Swat. There seemed a serious risk of deforestation with all its consequences in time threatening Darel and Tangir. But human hands were destined to avert this. Two years after my visit Raja Pakhtunwali met the fate familiar to the Khushwakt family by being murdered. Ever since, the tree-cutting operations have stopped as the tribal anarchy, re-established, makes it impossible for anyone to undertake timber contracts in safety. So nature is free once more to repair the damage done by human activity.

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VOLUME IV WINTER 1938/39 NUMBER 4

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